



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

5. Localization on a photograph, while giving some interesting results on other points, does not provide an accurate means of determining the limen of twoness.

X.—ON THE AFFECTIVE TONE OF SIMPLE SENSE-IMPRESSIONS.

BY D. R. MAJOR, B. S.

The aim of this study was largely methodological. We wished to test the validity of the serial method, already employed in æsthetics by Witmer,¹ and given by Külpe as one of the two principal methods of affective investigation.²

Our experiments were carried out in the months January to June, 1894. Just as we had prepared our material for publication, we received Vol. X., Pt. 4, of the *Philosophische Studien*, in which is contained J. Cohn's paper: *Experimentelle Untersuchungen über die Gefühlsbetonung der Farben, Helligkeiten, und ihrer Combinationen*. It seemed better to defer publication till we had compared the two sets of results. In what follows, therefore, constant reference will be made to Cohn's article.

Methodological.—Külpe writes of the serial method as follows: "Sie geht von der Thatsache aus, dass, wenn auch absolut die Gefühlswirkung eines Reizes unter verschiedenen Umständen sehr verschieden ausfällt, immerhin die einzelnen Reize das Gefühl in constanter Form *relativ* bestimmen oder beeinflussen können. Wenn ich z. B. in der Stimmung bin alle Farben gleichgiltig zu finden, so werde ich dennoch unter einer Anzahl mir vorgelegter Farbentöne Unterschiede ihrer Wirkung auf mein Gefühlsleben anzugeben im Stande sein Der Vorzug oder die Zurücksetzung, die den Werthen innerhalb einer solchen Reihe zu Theil werden, geben uns dann einen Aufschluss über die Abhängigkeit des Gefühls von den Reizen Eine strengere Ausbildung der Methode hat noch nicht stattgefunden Bei [ihr] ist offenbar die Abhängigkeit der Gefühle von den Reizen im allgemeinen nur durch eine Curve darstellbar, deren Verlauf die subjectiven Aenderungen zur Anschauung bringt, die einer bestimmten Aenderungsform der Reize entsprechen. Die einzelnen Werthe dieser Curve haben keine absolute Bedeutung, sondern sind lediglich abgestuft zu denken vom relativ Unangenehmsten bis zum relativ Angenehmsten Wir können uns die Gefühlsänderung selbst als einen rein

¹*Phil. Stud.*, IX., pp. 209 ff.

²*Grundriss*, p. 239.

quantitativen Process vorstellen, in dem das relativ Unangenehmste ein Minimum, das relativ Angenehmste ein Maximum bildet. Alle Zwischenstufen zwischen diesen Grenzwerten würden eine stetige Verbindung zwischen ihnen herstellen"¹

Cohn (1) recommends the "gründliche Heranziehung einzelner Personen" (p. 564). Our experience coincides with his. We confined ourselves to the examination of three subjects: Miss Carss (*C.*), Miss Hunt (*H.*), and Mr. Lighty (*L.*). (2) He declares the serial method inapplicable to colors, for two reasons. In the first place, the qualities contrast with one another, so that a different impression follows from each particular presentation of a series. Secondly, the separate colors "operate not as members of a continuous series, but as independent qualities." Both objections are true: but it is a question whether one should give the method up altogether on their account. We endeavored to meet them, as follows.

I.

To take visual impressions first:—there is the initial difficulty of a color and brightness standard. Cohn, in face of this difficulty, constructed a color circle.² "Man sieht . . . wie roh und unexact dieser Farbenkreis ist. Im Folgenden wird sich zeigen, wie gute Dienste er trotz alledem leisten kann." We made no attempt at a new standard, but simply cast about for a convenient series of colored and bright surfaces. Such a series we found in the Bradley Educational Colored Papers (dead finish).³ The "spectrum scales" of the M. Bradley Co. contain ninety-five saturations; nineteen fully saturated or typical colors, and, for each of these, two less saturated qualities, obtained by the intermixture of different degrees of black, and two obtained by the intermixture of white. The company kindly sent us a number of unclassified additional papers, which we arranged like the rest, as carefully and accurately as possible. We thus obtained a total of 137 color qualities. Besides these, we had twelve qualities from those of the brightness scale.

The first objection to the serial method is the influence of contrast. This renders it impossible to present a series of colors simultaneously. To avoid it, we exhibited but one visual quality at a time. Squares of 6 cm. were cut from the

¹*Op. cit.*, pp. 239-242, 254, 257, 260. For the method as employed by Witmer, cf. *Phil. Stud.*, X., p. 563.

²Pp. 566-569.

³See *The Bradley Color Scheme*, p. 6; *Bradley's School Aids*, pp. 1, 2.

stimulus papers. These were exposed, in two different experimental series, upon cardboard backgrounds of white and black respectively. The cardboard in each case was 60 cm. square. Behind it, at the distance of about 1 m., was a wall of neutral yellow-grey. The observer sat, with closed eyes, 2 m. from the card upon which the stimulus paper was exposed. The signal for attention was given 2" before exposure; the exposure was made for 2"; and some 10" were allowed for the recording of the affective judgment. Often less time was needed for this last.

This method of isolated exposure constitutes, of course, a radical modification of the serial method. Does it involve the serial method at all? And does it get rid, as it was intended to do, of contrast effects?

The answer to the first of these questions leads us to the second objection: that the colors operate as independent qualities. In our experiments they certainly did not. Our plan was: to begin the experimental series at any point in the spectrum; to move always, having begun, from right to left along the spectral series; to set out either from the whitest or from the blackest saturation of the color chosen as the first stimulus, and to present all the saturation degrees of this color before passing to the next,—then to take the saturation degrees of this next color in the same order,—and so on; and to give the whole series of 137 stimuli at each sitting. Thus the observers, who were familiar with the solar spectrum, knew the spectral direction of the series, and could hold the total scheme more or less definitely in memory; while at the same time the number of saturation degrees of each color afforded a sufficient break between color and color. The beginning of the total series at any point of the spectrum was a further correction of possible *Einstellung*. Again, not only were the impressions held together serially by aid of the memorial spectral scheme, but each separate group of saturation degrees of a single color formed a minor series in itself, from term to term of which the affective judgment might vary considerably. As stated above, the order of exposure of saturations might be either from dark to light or from light to dark; but it was constant within the same series, and therefore known to and expected by the observer after the first few impressions had been given.

On this method, contrast, if present at all, would plainly tend to be not contrast of color with color, but contrast of *e. g.*, the brightest saturation of one color with the darkest saturation of the next following. But of any such contrast effect there is no trace in the experimental results. Partly, it may be, the time interval between experiment and experi-

ment was long enough, and the time of exposure short enough, to prevent it; partly, the observers were on their guard against allowing expectation to pass over into comparison; partly, it seemed that, at the conclusion of each minor series of saturation degrees, this series was replaced in mind by the thought of the total spectral series—the expectant attention turned to the next color in general, and not to a particular saturation degree of it, so that, again, a direct mental comparison was avoided.

Of course, with either background, there was induction. And the error so introduced, though purporting to be constant, was not so in reality, since the brightness of the six “principal” colors in the Bradley scheme (as in the spectrum) are by no means the same. But it seemed unavoidable. Some trial experiments were made in the winter of 1893 with large colored surfaces. In every case the observer expressed himself as feeling “discomfort” in the presence of the extended stimulus, and was convinced that judgment would be more prompt and certain if the stimulus surface was reduced in size. Moreover, the extended color exhausts the retina, leaving the after-effects of exhaustion behind it. It is noteworthy that incidental remarks to this effect were dropped by the observers *C.* and *H.* during the present experiments.

(3) Cohn attributes to the serial method a “fundamental error.” It is inadequate. “*Sie kann nur einen oder den andern Hauptpunkt der Curve, nicht die Curve selbst feststellen.*” This is true of the method in its usual form. To obviate the difficulty, we formed an arbitrary scale of affective values. It was found, after a good deal of testing, that seven such values could be readily held in memory. They were: 1, very pleasant; 2, moderately pleasant; 3, just pleasant; 4, without affective tone; 5, just unpleasant; 6, moderately unpleasant; 7, very unpleasant. This scale was written upon a blackboard in the experimenting room; so that the observers could refer to it before experimentation began, and refresh their memory by casting a glance at it between experiment and experiment, before closing the eyes. If we take 4 as the abscissa of the affective curve, it is clear that 1, 2 and 3 may be regarded as positive; 5, 6 and 7 as negative ordinates.¹ We do not mean, of course, that there is anything absolute in the curve thus obtained. It was very quickly noticed, during our experiments with visual impressions, that the observers were not accustomed to attribute the terms “pleasant” and

¹ This procedure is not that criticised by Külpe, p. 241.

"unpleasant" to visual stimuli of the kind investigated. Hence, when it was required of them to predicate these terms, they attached individual meanings to them. *L.* persisted throughout in regarding as visually unpleasant only a stimulus which was absolutely injurious, destructive to the organ, such as direct sun-light. His curves, therefore, show hardly any negative ordinates. Often he described a color as "ugly"; but did not on that account find it "unpleasant." For *C.* and *H.*, on the contrary, "ugly" and "unpleasant" meant, so far as we could tell, the same thing. The curves of *L.* and of *C.* and *H.* cannot on this account be compared with one another. Nor do we claim anything but relativity of result within the limits of the same curve. That 1 is so high above 4, absolutely, as 7 is below it, we have no means of knowing. What we do maintain, however, is that in these seven affective values, we have a sliding scale which is easily memorized, which assists the observer in the formation of an affective judgment, which is applicable to the series of impressions whatever the mood (*Stimmung*) of the observer at the time of experimentation may be, and which removes in a relatively trustworthy way the "fundamental" objection of the inadequacy of the serial method. The results shall speak for themselves later. It should be mentioned that to eliminate the direct memory error, we worked only once a week.

The Affective Judgment.—Our notes on this head practically coincide with those of Cohn (pp. 596 ff.). We noticed the difficulty of obtaining the "gleichmässige Gemüths-lage" from the observers. This is partly due to the causes enumerated by Cohn (the confusion of the æsthetic with the affective judgment, the conviction of the "subjectivity" and uncertainty of the experiment, etc.); partly to a cause which we have mentioned above, the unaccustomedness of the required judgment. We found, again, the tendency to theorize; to put reflection in the place of direct experiencing. We were not able, however, like Cohn, to treat our observers' suggestions with "cool scepticism," at the time of their utterance. This would have meant a discontented mood and variable judgment on their part. We treated the suggestions with some respect; but discouraged their making during an experimental series. In other words, instead of discouraging introspection altogether, as Cohn did, we worked towards mechanization during the experimental hour, but allowed the observer to introspect memorially at its conclusion. Many of the suggestions could be discounted at once; but the observer — ignorant of the actual aim of the investigation — was flattered and put into a good mood by being able to discuss

them, and see them noted down. The point is a difficult one ; and every observer must be to some extent individually handled with regard to it.

We noticed, like Cohn, that the number of distracting associations decreased as the experiments progressed. This we ascribe partly to the serial nature of the impressions (Witmer), partly to the number of experiments made (Cohn). There were, altogether, but few associations. The observer *L.* remarked that it was generally possible to judge of the color as color ; but that if once a train of association was allowed to start, it was liable to persist. This latter statement was confirmed by the other two observers. Greens seemed for all three observers to be the richest in associations. It was hard to discover the reason : *C.* suggested the green of vegetation, *L.* silk dresses. There were three main types of association : (*a*) with natural objects—flowers, birds, etc. ; (*b*) with moods (Cohn, p. 590) ; (*c*) with objects of analogous attributes, delicate tones being associated to fragile fabrics, etc. (Cohn, pp. 565, 598.)

As regards the effects of mood, the utterances of our observers differ somewhat from those of Cohn. He found that a particular mood might condition a particular judgment ; and that a good mood meant a better cognition of affective differences. We obtained no instance under the first rubric : that may be simple accident. As regards the second point, we noticed that “good spirits,” a pleasant day after much wet weather, etc., so far from emphasizing the differences between the pleasant and unpleasant impressions, sent all impressions alike up in the direction of pleasantness. Mood appears to be a factor which varies with different individuals.

Two of Cohn’s observers remarked on occasion that the order of experimentation influenced judgment. One of our own (*H.*) made a similar remark two or three times. But the remark was made as an “impression” at the conclusion of the experimental series ; and no trace of any such influence could be found in the observer’s results. Such unreliable “impressions” are especially apt to arise in unfavorable moods. In certain cases the direct result of stimulation of the sense-organ determined the affective judgment. “Cool,” “restful” colors were pleasant ; dazzling, blinding, “angry” colors unpleasant. The cases are not numerous.

Results of Experiments with Visual Impressions.—We proceed to give in Table I the results of experiments upon our 137 saturations. The spectrum is divided into twenty-seven qualities, described as : between violet-red and red-violet ; violet-red ; red ; orange-red ; red-orange ; orange ; yellow-orange ;

orange-yellow; yellow; green-yellow; between green-yellow and yellow-green; yellow-green; green; green-blue-green; blue-green; between blue-green and green blue; green-blue; extra green-blue; slate blue; blue; violet-blue; blue-violet; slate violet; violet; extra red-violet; extra violet-red; red-violet. The nomenclature is, as has been indicated, to a certain extent arbitrary. For each of these qualities there is a principal quality or most saturated color; (this is placed in the curve upon the vertical line indicated above by its initial letter or letters, and below by asterisks;) and a number of less saturated qualities, dark and light. The order in the curve is in each case from light to dark. The total number of saturations, besides the normal color in each minor series, is: (1) 2 light and 3 dark; (2) 2 and 3; (3), (4) 2 and 2; (5) 3 and 2; (6) 4 and 2; (7) 3 and 3; (8) 2 and 3; (9), (10) 2 and 2; (11) 2 dark only; (12) 2 and 2; (13) 2 and 3; (14) 1 and 3; (15) 2 and 2; (16) 1 and 1; (17), (18) 2 and 2; (19) 1 and 1; (20), (21), (22) 2 and 2; (23) 2 dark only; (24), (25) 2 and 2; (26) 2 and 3; (27) 2 and 2,—in all, as stated, 137. It may be noted that while the normal series for each color contained five qualities, there was sufficient irregularity to prevent any exact definitizing of the attention:—another reason for the absence of contrast effects in the results.

The figures in vertical lines to the left of the curves represent the affective judgments; 1 = very pleasant, 7 = very unpleasant.

The first letter above each curve gives the name of the observer. The seventh curve (*W.*) was taken from a subject not hitherto named, Miss L. Washburn, who was only present during the first part of the investigation.

The second letter gives the background; *W.* = white, *B.* = black.

The figure following shows the number of times that affective judgments were recorded by the observer for the whole series of 137 saturations, apart from practice experiments.

All experiments were made in diffuse daylight, under constant conditions of illumination.

Several questions arise in connection with this table.

(a) Was the affective judgment constant? And if so, within what limits? It would appear to be a defect of the serial method in the form in which we have employed it, that but few judgments of the same stimulus can be taken. Thus although *C.*, *e. g.*, was the subject of 1,233 experiments with the black background, each particular saturation was affectively estimated only nine times. It might be expected that this would mean a very large *m. v.* But the results give the con-

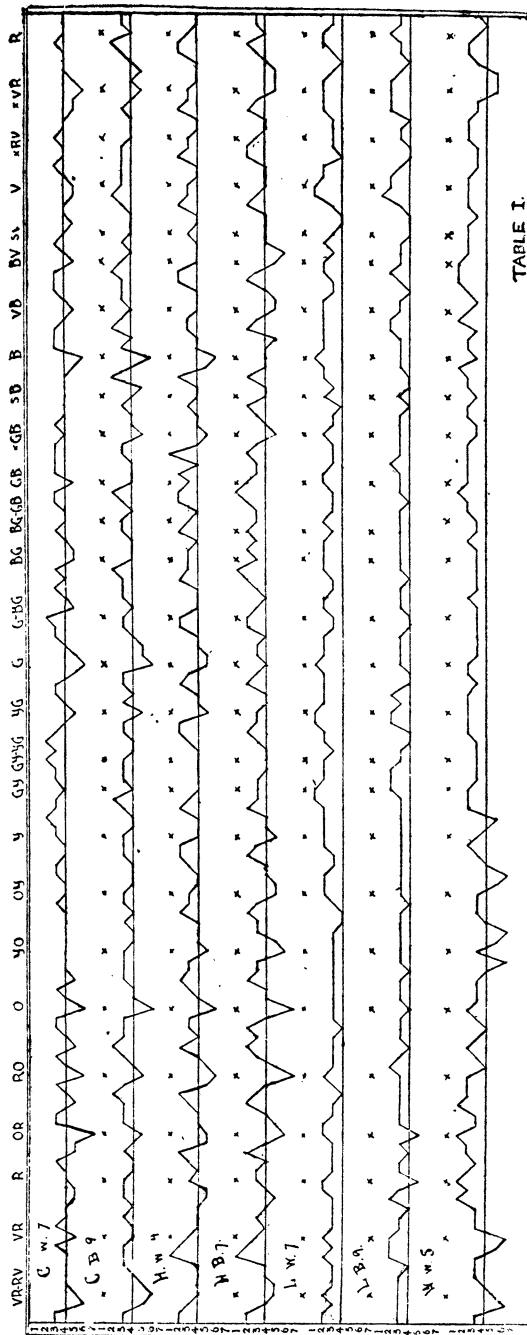


TABLE I.

trary verdict. On the average, for each individual, there was a quite unexpected constancy of judgment.

It would be easy to prove this constancy by giving the *m. v.* for each of the 137 saturations and for each observer. But, apart from the cumbrousness of such a method, the table constructed would be to some extent misleading. First, the judgment-series present several well-marked types,—which could not be differentiated; while, secondly, the same *m. v.* would have a very different psychological value, according as it was a variation within one and the same affective quality, or between the two, of pleasantness and unpleasantness. We will, therefore, rather enumerate the types of judgment-series obtained, together with actual illustrations of them, these illustrations serving to indicate the range of the *m. v.*

i. *Perfectly regular affective series.* *L.*; 1, 1, 1, 1, 1, 1, 1, 1. *H.*; 3, 3, 3, 3; 5, 5, 5, 5, 5, 5, 5. *C.*; 3, 3, 3, 3, 3, 3, 3, 3. *W.*; 2, 2, 2, 2, 2. These series were naturally rare; although considerably more occurred than we had looked for.

ii. *Affective series becoming regular as experimentation progressed.* *C.*; 5, 5, 3, 3, 3, 3, 3. *L.*; 4, 3, 3, 3, 3, 3, 3. These were more numerous.

iii. *Series varying within the same affective quality.* *C.*; 5, 5, 6, 6, 7, 6, 6: or 5, 6, 6, 6, 5, 6, 6, 5, 5. *L.*; 2, 2, 2, 1, 1, 3, 3, 3, 2. *H.*; 7, 5, 7, 6. *W.*; 5, 7, 5, 5, 6. These were very numerous indeed.

[Cross-series between ii. and iii. were common. Thus: *C.*; 2, 5, 5, 6, 5, 5, 5. *H.*; 3, 2, 2, 2, 2, 1, 2.]

iv. *Regular series abruptly broken by a single term.* *C.*; 5, 5, 5, 5, 3, 5, 5; 3, 3, 3, 4, 3, 3. *H.*; 3, 3, 2, 3; 4, 4, 2, 4.

[The pure type is not very common. Quite frequent, on the other hand, are cross-series, involving iv. and iii., iv. and ii., or all three types. Thus: *C.*; 4, 5, 5, 5, 3, 5, 5=ii. and iv.; *C.*; 1, 2, 3, 3, 4, 3, 3, 3, 3=ii. and iv.; *C.*; 5, 3, 6, 5, 6, 5, 5=iii. and iv.; so *H.*; 5, 5, 3, 6, 5, 5, 5; and *L.*; 5, 5, 6, 5, 5, 3, 5; or 3, 7, 2, 2, 2, 3, 3; *L.*; 2, 3, 3, 3, 3, 5, 3, 3, 3=all three; etc.]

v. *Progressive and regressive affective series.* These are very rare; and cannot, we think, be referred to any but variable influences. We have only the following out of the total number of series: *L.*; 2, 3, 3, 3, 3, 3, 5, 5, 5: *H.*; 1, 3, 3, 3, 3, 5, 5 (this may really be a combination of ii. and vi.): *C.*; 5, 5, 5, 5, 6, 5, 6, 7, 7 (this is a cross-series of iii. and v.): *H.*; 5, 7, 5, 5, 2, 2, 2 and 5, 7, 7, 5, 3, 3, 3 (iii. and v.); *cf. L.*; 6, 4, 3, 1, 2, 2, 2. These six or five cases, taken together with a very few doubtful

ones, seem to require the rubric. We can understand that familiarity should make an impression pleasanter ; but it is difficult to understand why one should become less pleasant,—unless acquaintance with so large a color series gave the subject a richer mental furniture, and made him or her more critical as experimentation progressed. In neither case do we imagine recognition to have taken place.

- vi. *Series of indifference.* By our figure 4 we do not, of course, understand a new affective quality, beyond those of pleasantness and unpleasantness ; the judgment “no affective tone” corresponds to it. We can here distinguish sub-types :

(a) *Regular non-affective series.* *H.*; 4, 4, 4, 4, 4, 4, 4 ; so *C.*—*L.* has 4, 4, 4, 4, 4, 1, 4 (complication of vi. *a* with iv.). The type is fairly common with *H.*; else rare.

(b) *Vacillations round the non-affective judgment.* *C.*; 5, 5, 3, 5, 3, 3, 3 ; a series whose type frequently recurs in *C.*'s results. *H.*, 3, 3, 5, 5, 5, 3, 3 ; etc. Besides these, we have series in which the 4-judgment itself occurs. *H.*; 4, 5, 5, 4, 3, 3, 3 ; or 3, 3, 4, 4, 4, 4, 4 (*cf.* ii.). *C.*; 4, 3, 4, 3, 4, 4, 5, 5, 4. *L.*; 3, 4, 4, 4, 3, 5, 4, 5, 4. [Cross-series were again frequent.] With these, *cf.* the *Gleichheitsurtheile* mentioned by Cohn, p. 598.

- vii. *Irregular series.* These are very rare ; most seemingly irregular series reducing themselves to order on a close inspection. We find: *C.*; 3, 2, 6, 5, 3, 3, 4 ; 5, 3, 3, 6, 7, 5, 5 ; *L.*; 2, 3, 1, 4, 5, 3, 5 ; *H.*; 3, 7, 6, 3, 6, 3, 3 ;—but these are the only instances of really irregular series ; and even of them, the second and third are perhaps regressive. Such series as: *L.*; 6, 4, 3, 1, 2, 2, 2 show (as remarked above) a distinct affective tendency. Again, we have from *C.* the series: 2, 2, 6, 7, 6, 3, 3,—but notes on the observer's record-cards explained the three high figures as due to a particular influence.

These statements must not be misunderstood. The results are by no means artificially regular. Types i. and vi. *a* are rare, as stated. Nearly every series shows irregularity of some sort. But the variation is either by way of an isolated interruption (type iv.), due to mood, etc., or lies within one and the same affective quality (type iii.; extremes 1 and 3, or 5 and 7). In no other instance than those mentioned is there a variation from 7 to 3, 6 to 2, or 5 to 1, which is not referable to one of the above rubrics. We ascribe this regularity partly to the unaccustomed nature of the required judgments,

—the observers tended to move cautiously within the limits prescribed for them, so that the values 5 to 2, inclusive, predominate in the records; partly to the mechanization of the judgment,—a point emphasized by Cohn; and partly to the taking up of a definite affective attitude toward particular saturation types. Of this last, more presently.

Plainly, the giving of the *m. v.* of these results would be useless, and even misleading. The results require careful individual evaluation.

(b) Is a greater or less degree of saturation on the average more pleasant? Cohn writes: "Von zwei Nüancen derselben Farbe gefällt die gesättigtere besser. Auch unter einer Reihe verschiedener Farber werden im allgemeinen die gesättigteren bevorzugt" (p. 511). A glance at the first four curves of our Table I. will show that for the observers *C.* and *H.*, precisely the opposite holds. There is generally an "absolute" unpleasantness attaching to the more saturated colors; nearly always a relative unpleasantness. The curves are exceedingly regular in this respect. For *L.* it is different. The most saturated colors usually coincide with high ordinates throughout his first curve; and with fairly high ones in the second part of the second. In the first half of the latter, however, some of the most saturated colors coincide with minima of pleasantness. *W.*'s curve varies in this respect. At the beginning and end, the curve drops for saturated impressions; but over the greater part of its course it rises to them, or remains stationary when they occur.

Cohn's rule, then, is not universal (p. 600). There are great individual differences. When one thinks how dependent the sense-feeling is upon central excitations, that is not to be wondered at.—Of course, Cohn used a different method from ours, and employed principally gelatine plates and rotating discs where we had colored papers. Still, this cannot of itself account for the discrepancy.

Cohn continues: "Unter annähernd gleichgesättigten Farben scheint die Bevorzugung auf rein individuellen Neigungen zu beruhen. Nur das Gelbe dürfte für die Mehrzahl hinter den anderen Farben zurückstehen, auch wenn es ganz gesättigt ist." Taking our own most saturated colors, *R*, *O*, *Y*, *G*, *B*, *V*,—although we do not mean to imply that their saturations are absolutely equal,—we find that:

- (i.) *C.* makes *O*, *G* and *B* distinctly unpleasant; *R*, *Y* and *V* just pleasant, just unpleasant, or indifferent.
- (ii.) *H.* makes *O* distinctly unpleasant; *B* rather so; *R* just pleasant; *G*, *Y* just unpleasant or indifferent; *V* just pleasant or indifferent.

(iii.) *L.* makes the right hand of the spectrum more pleasant than the left. *R* alone falls below the abscissa of "no affective tone."

(iv.) *W.* makes *R* the most, *B* and *Y* the least pleasant colors. All are pleasant.

Here we have full evidence of the "individuelle Neigung;" but none of a dislike of yellow. Yellow is just pleasant for *C.*; just unpleasant or not toned for *H.*; moderately or just pleasant for *L.*; just pleasant for *W.* Cohn's caution as to the insufficiency of his own results is, therefore, well in place.

(c) We may examine this same question, of the relative pleasantness of saturation degrees, in connection with the further question of the influence of the background. If we take the twenty-seven best saturations of our color series, and count the no-tone judgments half to pleasantness and half to unpleasantness, we find that :

<i>C.</i>	on white	makes	8.5	pleasants,	18.5	unpleasants.
"	" black	"	13.5	"	13.5	"
<i>H.</i>	" white	"	15.5	"	11.5	"
"	" black	"	12.5	"	14.5	"
<i>L.</i>	" white	"	27.0	"	0.0	"
"	" black	"	23.5	"	3.5	"
<i>W.</i>	" white	"	23.5	"	3.5	"

Even this table, which throws together saturation-values of very considerable difference, indicates, when its values are compared with the total numbers of "pleasant" and "unpleasant" judgments (their totals being similarly obtained, by halving the no-tone judgments), that Cohn's rule of the superior pleasantness of the saturated color is not universal. We find that, in all :

U. on white makes 77.5 pleasants, 59.5 unpleasants.

" " black " 98.0 " 39.0 "

H. " white " 91.5 " 45.5 "

" " black " 94.0 " 43.0 "

L. " white " 132.5 " 4.5 "

" " black " 123.0 " 14.0 "

W. " white " 120.5 " 16.5 "

In other words :

<i>C.</i>	on white	makes, of all,	58%	pleasant;	of the	27,	31%
"	" black	"	71%	"	"	"	50%
<i>H.</i>	" white	"	66%	"	"	"	57%
"	" black	"	68%	"	"	"	46%
<i>L.</i>	" white	"	96%	"	"	"	100%
"	" black	"	90%	"	"	"	87%
<i>W.</i>	" white	"	88%	"	"	"	87%

So much, then, for Cohn's generalization. We turn now to the second question: that of the influence of the background.

If the members of each of the three first pairs of curves are compared with one another, it will be seen that the type of each pair is constant; 1 and 2 are alike, 3 and 4, 5 and 6. This fact, we may remark incidentally, tells distinctly in favor of the method employed.

Comparing the curves of each pair in detail, we obtain the following results: (i.) In neither curve does *C*. pass the affective value 2; in one case only does she sink to the value 7 (white, *O R*). White has, as we have seen, 13% less pleasant judgments than black. Black, too, has 19% more of the best saturations pleasant than white. White has, in all, 35 no-tone judgments; black 38. On the average, then, the saturations were a little pleasanter on black than on white. In particular: from the beginning to *R*, black is pleasanter; from *R* to *O*, black; from *O* to *Y*, black; from *Y* to *G*, white; from *G* to *B*, both are practically equal,—black having the advantage in the height of the pleasure ordinates; from *B* to *V*, black is pleasanter; from *V* to the end, black. (ii.) *H*. reaches the value 1 twice, on white; three times on black, she sinks to 7 twice, on black. Black has 2% more of pleasanths than white. The best saturations have 11% less pleasanths, however, on black. White has, in all, 57 no-tone judgments; black 33. Neither background, it is plain, can be said to be more or less pleasant than the other for this observer. Black, however, called out more affective judgments, and shows more extremes, both of pleasantness and unpleasantness, than white. In detail: from the beginning to *K*, white is slightly pleasanter; from *R* to *O* there is practical equality; from *O* to *Y*, again; from *Y* to *G*, black is pleasanter; from *G* to *B*, black; from *B* to *V*, white (the effect of black is to "impair" these colors, the observer stated); from *V* to the end, there is equality. (iii.) *L*. gives the value 1 eight times on white, once only on black. No impression is unpleasant on white; two are, on black. White has 6% more pleasanths than black; the best saturations on white, 13%. White has in all 9 no-tone judgments; black 26. The white background, then, is obviously the pleasanter. The observer himself recorded this fact only in regard to the blues. White is pleasanter for every section of the curve; particularly, however, between *O Y* and *B V*. (iv.) It is unfortunate that we have no black curve to compare with the last one of the table. This curve is particularly well marked: there is distinct dislike, *e. g.*, of the oranges and purples on a white ground. Such a regional dislike is not manifested by the other

observers. *L.* hints at it, for the reds on black. In the other curves, pleasanths and unpleasanths alternate in more individual preference.—*Cf.* §4 of Cohn's *Results*, p. 600.

(*d*) Are dark or light saturations the pleasanter? If we take the "shades" (dark saturations) and "tints" (light saturations) of the twenty-five qualities (omitting the slate-blue and the slate-violet), we find that, on white:

<i>C.</i>	makes	7	shades and	5	tints	pleasanter:	13	no-preferences.
<i>H.</i>	"	2	"	"	23	"	"	no " "
<i>L.</i>	"	5	"	"	7	"	"	13 " "
<i>W.</i>	"	6	"	"	14	"	"	5 " "

Here are two types, evidently: *C.* and *L.* have no preference, while *H.* and *W.* distinctly prefer the brighter saturations. Further, on black:

<i>C.</i>	makes	1	shade and	21	tints	pleasanter:	3	no-preferences.
<i>H.</i>	"	1	"	"	24	"	"	no " "
<i>L.</i>	"	7	"	"	5	"	"	13 " "

Here are the same two types. *C.* has gone over to the other side; she and *H.* find the brighter saturations distinctly pleasanter. *L.* continues to show no preference. *C.* noted this change of her affective judgment more than once on her record card.

There is no hint of a preference for the darker saturations in the results of any of the observers.

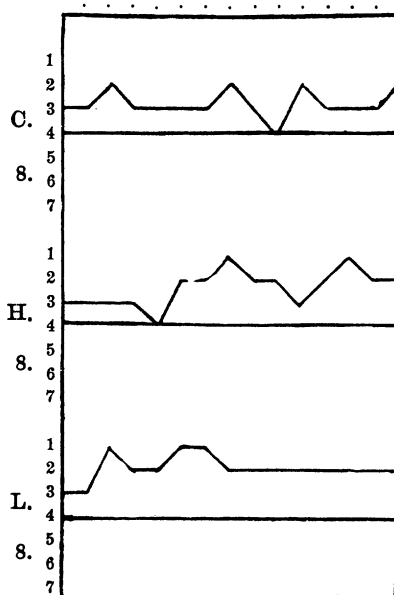
(*e*) Experiments upon the affective tones of the qualities of the brightness-scale were made upon both backgrounds. No brightness-impression is, probably, entirely colorless. Adopting the Bradley nomenclature, we had: a slightly greenish grey, three saturations of "grey," two of "cool-grey," two of "neutral grey," and two of "warm grey," besides white and black. Judgments were taken from *C.* 8, from *H.* 7, and from *L.* 8 times. (*a*) Of the eleven judgments on black, *C.* has 8 marked "no-tone," 3 "pleasant" (values 2, 3, 3); *H.* has 2 marked "no-tone," 8 "pleasant" (seven 3's and one 2), and 1 "unpleasant" (5); while *L.* has 2 marked "no-tone," 7 "pleasant" (3), and 1 "unpleasant" (5). The two unpleasanths are white and green-grey. On the whole, then, the qualities on black are just pleasant or indifferent. The individual differences are curious. White gets 3 from *C.* and *L.*, but 5 from *H.* The latter figure tells against Cohn's law of contrast (p. 600). Green-grey gets 2 from *H.* and *C.*, while *L.* gives it 5. This grey, then, is pleasanter than white to *C.* and *H.*, on the black background; while *L.* finds 8 qualities pleasanter than it, of which

white is one. The other judgments, 3's and 4's, are irregularly distributed. There is no trace of the preference of white over grey, found by Cohn, except a very equivocal one in *C.*'s figures. (*b*) The judgments on the white ground are all 3's and 4's, irregularly distributed; except that both *C.* and *L.* give a 5 to the green-grey. *W.* took part in this series, with seven sets of judgments. Black is not pleasanter on the white than any of the greys, with the exception mentioned.—The qualities on the whole, then, are just pleasant or indifferent.

II.

Experiments with Pure Tones.—We made a number of experiments with König tuning-forks. Preparation and signal were as before. The fork was then struck a sharp blow with a cork hammer, and judgment made at once, as the tone became full and clear. The fork was damped, so soon as the experimenter observed that all the subjects had realized the affective tone of the stimulus. A compound piano clang was given after each experiment, to prevent the influence of tone by preceding tone. The order of stimulation was quite irregular. The vibration-rates of the forks, in simple vibrations, were: 512, 576, 640, 682, 768, 853, 960, 1,024, 1,250, 1,536, 2,048, 2,304, 2,560, 1,792. In the table the judgments are recorded in this order.

TABLE II.



The observers again remarked on the unaccustomedness of the ascription of an affective tone to the stimulus. The table shows individual differences: *L.*, as before, is more lavish of his "pleasant" judgments than are *C.* and *H.* For *C.*, the e^3 falls from 2 to 3, the e^4 from 3 to no-tone, the e^5 stays at 3. The d^3 and d^5 are differently toned, so the g^3 and g^4 . The three *c*'s are constant at 3. For *H.*, the *e*'s are at 3, 2, 2; the *d*'s at 3 and 1; the *g*'s at 2 and 3; the *c*'s at 3, 2, 2. For *L.*, the *e*'s are at 2, 2, 2; the *d*'s at 1, 2; the *g*'s at 1, 2; the *c*'s at 3, 2, 2. We lay no stress upon this regularity or irregularity,—the experiments have not a sufficient range,—upon the fact that for *H.* the higher tones seem more pleasant, or upon the fact that no judgment falls below the value 4. The method can hardly be called "serial"; the serial element has been modified practically to disappearance. We would conclude from the results simply this: (*a*) that the smallness of the *m. v.* (each curve implies eight sets of judgments) shows that the affective judgment, once made, is persistent; (*b*) that individual differences exist here, as for sight, and that these differences are both general (*cf.* the three curves) and particular (*cf.* *C.*'s attitude to the *e*'s).

III.

Experiments Upon Active Touch.—These experiments were made upon a series of fifty-one textures. The observer sat with closed eyes. At a signal he laid his open right hand upon a rest. A piece of the fabric under consideration was placed between the thumb and index finger by the experimenter; and the observer moved it to and fro, "feeling" and "judging" it for 2". Then at a further signal the experimenter removed the stimulus, and the subject recorded his affective judgment.

The stuffs employed cannot be qualitatively classified unless at very great length. We have thought it best, therefore, simply to name them. Samples can be supplied by the laboratory, if anyone should wish to repeat the work with the same stimuli. The following list follows the order of the judgments recorded in the curves from left to right: it was the constant order of experimentation.

Linen canvas, open and close; linen toweling, coarse, medium, fine; gingham, thicker and thinner; percaline; India dimity; butterfly cloth; cotton sateen; cotton silk, thinner, thicker, thinner-and-smoother; gingham, thicker, thinner (both thicker than the two previous kinds); wool serge, thin; Paris cachemère; princess duck; challie laine; wool checks, thin, thicker, thicker; cotton plush, thick, thicker, thick soft, thin soft; flannel; velveteen; washing

silk; organdie, rougher, smoother; broadcloth, thicker, thinner; unbleached muslin; chambray, thinner, thicker; wool serge, thick; Irish lawn; cotton silesia; sateen, rougher, smoother; table linen, bleached and unbleached; dress goods; gingham, ribbed; faced velvet, thick, thicker, thin, thickest; gingham, thick and smooth.

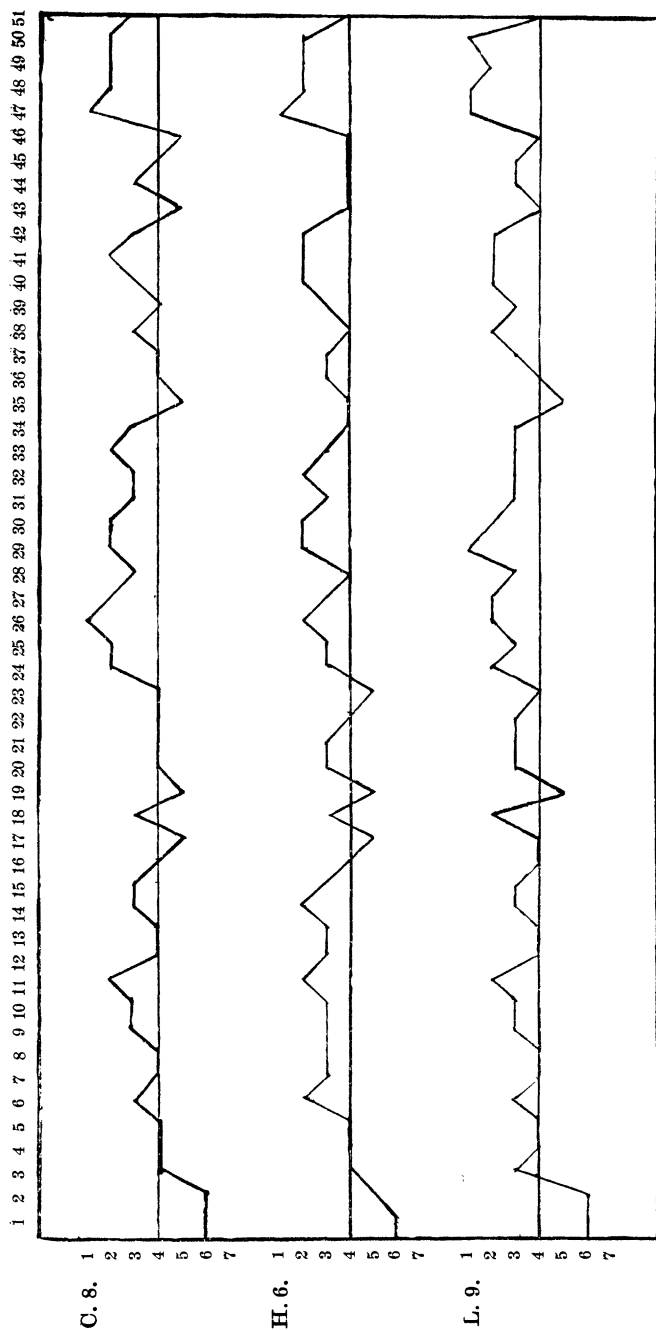
A serial arrangement of these stuffs in any way analogous to the spectral arrangement of colors, could not be carried out: there were too many variables. But we kept the minor series together (as we did the saturation grades of the same color), except in the single case of the ginghams, which we separated from one another for methodological reasons. [The two wool serges were extremely unlike.] We wished to see whether this separation exerted any bad influence, or whether the serial nature of the method—contrast being presumably less marked than in optics—would not be maintained by the simple fact of all judgments coming from the same modalities. We regarded this as probable, because whereas the eye has in all likelihood 40,000 to 50,000 qualities, we have involved here simply pressure and temperature from the skin, and the few qualities of the deeper lying sensibilities that go to make up the movement perception. This ought, we imagined, to hold the stimuli together as a series. We give the curves on page 74.

(a) The observers noted that it was far more "natural" to attribute affective tone (and particularly unpleasantness) to these stimuli than to those of sight and sound. And the curves support this: they are all three very much alike,—there is no such indication of individual differences as we have found in the other two tables.

(b) The affective judgment was constant, and showed types similar to those enumerated in the first part of this paper.

- i. Occurs twice only. *C.*; 3, 3, 3, 3, 3, 3, 3, 3; *H.*; 2, 2, 2, 2, 2.
- ii. Numerous. *C.*; 1, 2, 1, 1, 1, 1, 1; and 4, 5, 4, 4, 5, 5, 5, 5; etc.
- iii. Very numerous. The variation is often between two degrees only. *C.*; 1, 2, 2, 2, 2, 1, 1, 1; *H.*; 3, 2, 3, 3, 2, 3; *L.*; 5, 5, 5, 5, 5, 5, 6, 5, 6; and 3, 2, 3, 2, 2, 2, 1, 2, 2; etc.
- iv. Not very common even in the "cross" form. Pure series are: *H.*; 2, 2, 2, 2, 4, 2; and 1, 1, 1, 1, 1, 3; etc.—uncommon. Cross-series are: *O.*; 4, 3, 5, 5, 5, 5, 4, 5 (iv. with ii.); *H.*; 4, 5, 4, 4, 4, 3, 4. We should naturally expect that the interruption would be neither so frequent nor so pronounced in a sense modality in which

TABLE III.



the dependence of affective tone upon stimulus is comparatively stable.

v. No commoner than for the colors, as we should, again, for the above reason expect. *C.*; 4, 5, 5, 5, 7, 7, 7, 7; and perhaps the already quoted 1, 2, 2, 2, 2, 1, 1, 1. These seem to be the only instances.

vi. There is no single occurrence of a variation from 7 to 3, 6 to 2, or 5 to 1. This, once more, was to be expected.

(c) There is no trace of the influence of contrast in the results. Associations were very few indeed: what there were, were visual,—and usually themselves associatively affective. There was no recognition of the textures from week to week as particular members of the experimental series; though, of course, such stuffs as velvet were known by touch. The stimulus attributes that seemed to the observers to call up the affective judgment were thickness and thinness, coarseness and fineness, roughness and smoothness, stiffness and softness. We can test this by reference to the curves.

First, however, we will look at the judgments made of the scattered gingham and chambrays. These judgments are numbers 6, 7, 15, 16, 36, 37, 46, 51. We find the values to be :

C.; 3, 4, 3, 4, 4, 4, 5, 3.

H.; 2, 3, 3, 4, 3, 3, 4, 4.

L.; 3, 4, 3, 4, 4, 3, 4, 4.

This constancy, we think, is sufficient to prove our hypothesis correct, when it is considered at what different points of the curves these judgments occur. That we might have been even bolder, methodologically, is shown by the judgments attaching to isolated similars, such as numbers 11 and 41, 42; or 29, 47, 48, 49, 50. We have in these cases :

C.; 2, 2, 3; and 2, 1, 2, 2, 2.

H.; 2, 2, 2; and 2, 1, 2, 2, 2.

L.; 2, 2, 2; and 1, 1, 1, 2, 1.

The absolute likeness of the three curves is no less striking than their relative constancies.

As regards the stimulus qualities, *stiffness* may be predicated especially of numbers 1, 2, 19, 35, 43; *softness* of 11, 18, 30, 38, 40, 41, 42. It will be seen that the curves give high affective values for the latter; low for the former. *Roughness* attaches especially to numbers 1, 12, 13, 14, 17, 20, 35, 46; *smoothness* to 18, 24, 25, 26, 27, 29, 30, 40, 41, 42, 47, 48, 49, 50. It is noticeable, again, that the "roughs" have (on the average) low, the "smooths" high affective

values in all the curves. *Coarseness* is especially characteristic of numbers 1, 2, 19, 35, 43; *fineness* of 9, 30, 31, 32. Though the former is distinctly unpleasant, it will be seen from the curves that the latter does not necessarily carry with it any high degree of pleasantness. Both facts are readily intelligible. Lastly, *thick* were numbers 24, 25, 26, 27, 33, 34, 38, 47, 48, 49, 50; *thin*, 20, 30, 31, 32. Here, too, the affective tone depended on a combination of qualities. Pleasant are 24 to 27, 47 to 50, the thick-smooth series; less pleasant 33, 34 and 38 (thick, but roughish). Again, pleasant is 30 (thin and smooth); less pleasant 31, 32 (thin, but less smooth); still less pleasant 20 (thin and rough).—We do not mean to imply that these eight stimulus qualities are psychological qualities. Psychologically regarded, their differences would be, to a large extent, matters of intensity only.

That thickness or thinness is in itself of little affective weight can be seen from numbers 3, 4, 5 (judged by *C.*, 4, 4, 4; *H.*, 4, 4, 4; *L.*, 3, 4, 4); 21, 22, 23 (*C.*, 4, 4, 4; *H.*, 3, 4, 5; *L.*, 3, 3, 4), and from the series of plushes and velvets. Still, the results show that the observers were right in attributing some influence to this pair of qualities. *H.* said that she preferred thin roughs to thicker; and her judgments are for the former (numbers 12, 13, 14, 20, 46) 3, 3, 2, 4, 4; and for the latter (numbers 1, 17, 35) 6, 5, 4. In the former set, we must remember that 12, 13, 14, though rough, were fine. Indeed, as indicated above, the difficulty of classification of the textures was due to the fact that a single piece usually combined different qualities.

It is difficult to say whether we are here still within the boundaries of psychology, or have crossed the border-line of æsthetics (*cf.* Höffding, *Psychologie in Umrisen*, 1887, p. 286). We incline to the former opinion.

Literature.—We refer the reader, primarily, to the literature section of Cohn's article. General discussions will be found in Wundt, *Vorlesungen*, 2d Ed., pp. 227, 228; *Phys. Psych.*, 4th Ed., ch. x.; Sully, *Human Mind*, II., pp. 49 ff.; Ladd, *Phys. Psych.*, pp. 514 ff.; *Psychology*, pp. 184 ff.; Höffding, *op. cit.*, pp. 285 ff.; etc.

Summary of Results.—(1) We have succeeded in modifying the *serial method* in such a way as to make it applicable to the investigation of the *affective tone of colors*. We publish our modification, however, not in any spirit of dogmatic assertion, but rather with a view to invite criticism both of the method itself and of our analysis of the conscious processes underlying it.

(2) The whole question of the *affective tone of colors* is a

very difficult one. This is due partly to the fact of the unaccustomedness of the affective judgment, partly to that of individual differences, and partly to the fact that the centrally excited influences which meet the incoming stimulus, and which are very strong, differ from time to time in one and the same individual.

(3) We cannot confirm Cohn's rule that the more saturated colors are the pleasanter; *individuals differ* in this respect. Neither can we confirm his generalization that yellow is displeasing to the majority of persons.¹

(4) No constant affective value can be attached to *black and white backgrounds*. We have found black a little pleasanter, white distinctly pleasanter, and no difference.

(5) As regards preference of *bright and dark saturations*, our observers fall into two groups: one prefers the former, one has no preference. There is no preference for the latter shown.—Here, too, the influence of the backgrounds is individually different.

(6) Experiments with *brightnesses* showed that all alike were just pleasant or not toned. We have no evidence of a preference of the black-white over other brightness contrasts, and no certain evidence of the preference of white over grey.

(7) The few experiments that we made with *pure tones* gave, like those made upon sight, regularity of results for each individual, but differences between individual and individual. In their case, the "modified serial" method ceased to be "serial" at all. The experiments were not continued, as the individual affective judgment, though constant, appeared to be something strained and artificial. This might not be the case with a different method.

(8) We have also found the method, in its modified form, applicable to the sensibilities of *active touch*.

(9) But the *affective tone of active touch* is something far more absolute, *i. e.*, far less dependent upon centrally excited influences, than that of colors and pure tones. The method, therefore, again practically loses its serial nature.

(10) *Stiffness, roughness and coarseness* of textures were unanimously found unpleasant; *softness and smoothness* pleasant. Fineness, thickness and thinness gave variable results.

For other results of detail we must refer the reader to the body of the paper.

¹It is difficult to see why yellow, unless so bright as to be painful to the sense-organ, should be so disliked. Yellow is the "warm" color of painters (Wundt, *Phys. Psych.*, 4th Ed., I., p. 568); although its "mood" is that of excitement, it has not the angeriness of red; we are greatly accustomed to it, in sunlight and artificial light; children prefer it (Freyer, *Seele des Kindes*, pp. 9 ff.).